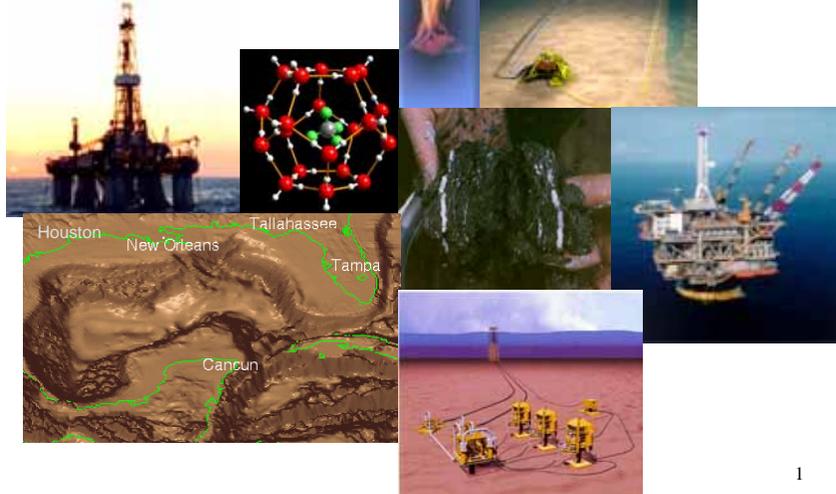


Characterizing Natural Gas Hydrates in the Deep Water Gulf of Mexico



What Are the Issues?

- **Gas hydrates are thought of as both a safety hazard and a potential resource**
- **The safety hazard issues are paramount for deep water exploration**
- **The potential resource issues will be important for energy supplies in future**
- **The industry needs to know more about these issues to operate safely**

Hydrate Mounds at the seafloor in the GOM

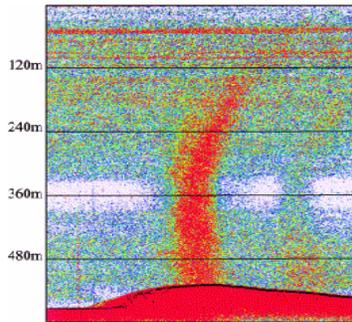


Figure 3-4 Echo sounder record of a gas bubble train entering the water column from gas vents on the GC 185 gas hydrate site. The mound-like seep feature is at ~540 m water depth, and the plume rises close to the sea surface (see vertical scale). The base of the plume is estimated to be ~600 m across. Over the site, gas bubbles 2-3 cm across breach the sea surface, associated with oil, demonstrating direct transfer of thermogenic greenhouse gas to the atmosphere (Sassen et al., 2001)

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Key Technical Issues

- **What are the properties of sediments containing natural gas hydrates?**
- **What measurements provide the most information?**
- **How can we use seismic for evaluation?**
- **How can we drill and core hydrates for both field and laboratory studies?**

Gas Hydrates JIP

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Basic Properties Not Understood



- Mechanical properties
- Sediment strength
- Thermodynamic properties



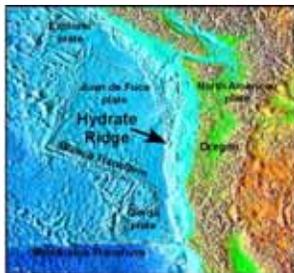
Sediments Recovered from the Arctic
Mallik Well - McKenzie Delta, Canada

Gas Hydrates JIP

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Scientific drilling at Hydrate Ridge

ODP Leg 204 - Offshore Oregon



- Water depth: 2587-4029 ft
- Drilled: 9 sites, 45 holes
- Recovered ~ 37 meters of hydrate containing sediments
- Similar to what JIP is planning for GOM



Key Business Issues

- **What are the safety problems associated with drilling through hydrates in deep water?**
- **What are the safety issues with placing facilities and pipelines in areas containing gas hydrates?**
- **What are the possibilities of someday producing natural gas from gas hydrates?**

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The ChevronTexaco JIP

- **A workshop was held by DOE in August 2000 to frame the issues**
- **Chevron formed JIP to write proposal to address the issues identified at workshop**
- **DOE awarded cost sharing contract with ChevronTexaco in September 2001 for Phase I**

Gas Hydrates JIP

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JIP Primary Objective

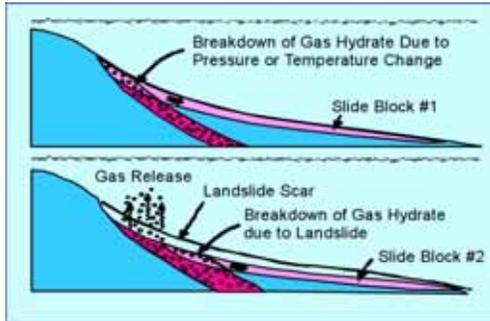
To develop technology and data to assist in the characterization of naturally occurring gas hydrates in the deep water Gulf of Mexico.

Because these hydrate deposits can cause problems related to drilling and producing conventional oil and gas fields, as well as building and operating pipelines.

Secondary Objectives

- To better understand how natural gas hydrates affect local seafloor stability**
- To gather data that can be used to study climate change**
- To determine how the results can be used to assess if and how gas hydrates act as a trapping mechanism for shallow oil and gas reservoirs**

Seafloor Stability Concerns



- Can we have slope failure due to hydrate dissociation?
- Can heat from conventional hydrocarbon production destabilize hydrate zones?

Please note that large scale sea floor stability issues are of interest to the JIP but not an area that it will address directly.

Gas Hydrates JIP

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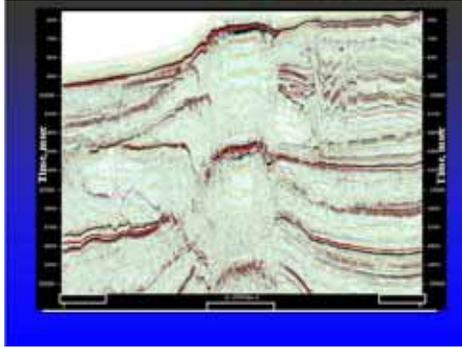
Phase I Tasks

- Data Collection and Organization
- Evaluation of Gas Hydrate Sensors
- **Develop Well Bore Stability Model**
- Seismic Modeling and Analyses
- Determine Data Requirements for Models
- **Develop Drilling and Coring Plans – Phase II**
- **Run Experiments on Synthetic Cores**
- **Select Locations for Phase II wells**

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Seismic Will be the Key Technology



- **Vertical and lateral distribution of hydrates**
- **Mechanical properties of the sediment**
- **Porosity**
- **Saturation**
- **Our seismic techniques must be good enough to select drilling sites**

Gas Hydrates JIP

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Challenge is How to Obtain High Quality Log and Core Data Safely



- **Drilling procedures**
- **Core cutting and handling**
- **Core analysis**
- **LWD or Open Hole**
- **Ensuring wellbore stability**

Gas Hydrates JIP

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Summary

- **This workshop is designed to review Phase I results and plans for Phase II**
- **Drilling on Leg 1 in Phase II will occur during Q2 of 2004**
- **Drilling on Leg 2 in Phase II will occur during Q2 of 2005**

Breakout Sessions

- **Drilling and Coring Procedures**
- **Core Handling Procedures**
- **Core Analyses Tests and Procedures**
- **LWD and Wireline Logging Requirements**
- **Detailed Site Selection Criteria**
- **Remote Sensing and Permanent Monitoring**